464-24 AU 2405 49207

(DE004140822A) GB 002251284 A
(JUN 1992) JUL 1992

(12) UK Patent Application (19) GB (11) 2 251 284 (13) A

(43) Date of A publication 01.07.1992

(21) Application No 9126678.3

(22) Date of filing 16.12.1991

(30) Priority data
(31) 4041747 (32) 24.12.1990 (33) DE

(71) Applicant
Luk Lamellen Und Kupplungsbau GmbH

(Incorporated in the Federal Republic of Germany)

Postfach 1360, 7580 Buhl, Federal Republic of Germany

(72) Inventor
Herr Johann Jackel

(74) Agent and/or Address for Service
Dummett Copp & Co
14 The Square, Martlesham Heath, Ipswich, IP5 7SL, United Kingdom

(51) INT CL[5]
F16F 15/12

(52) UK CL (Edition K)
F2U U206 U208 U286 U340 U396 U398
U1S S2012

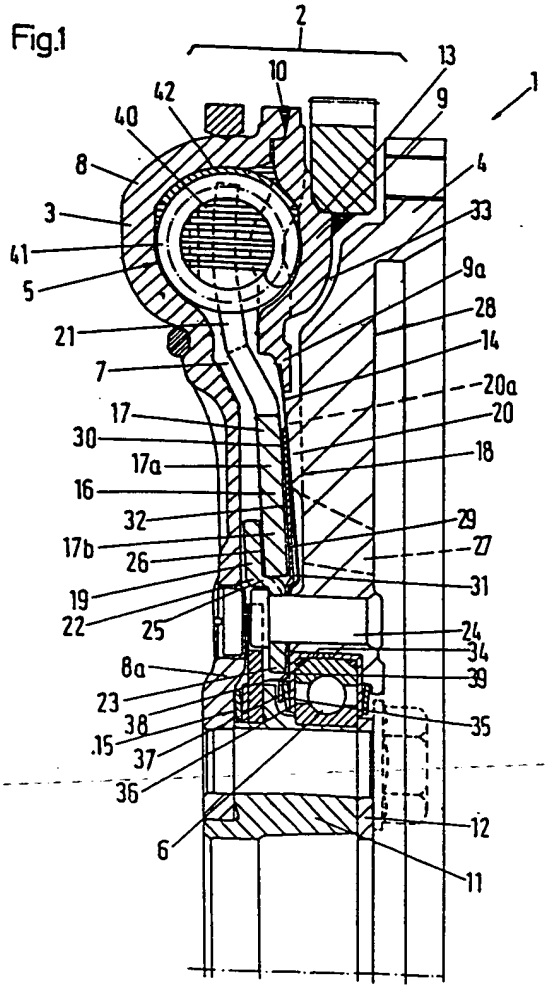
(56) Documents cited
GB 2217429 A

(58) Field of search
UK CL (Edition K) F2U
INT CL[5] F16D, F16F 15/12

(54) Torsional vibration damper

(57) A vibration damper, in the drive train of a vehicle between engine and gearbox comprises a flywheel having two parts, 3, 4, ~~rotatable relative to one another.~~ The relative rotation is opposed by springs 41 in a chamber 7 containing a viscous medium and a slip coupling 18 in series. The slip coupling comprises a plate spring component 17 which acts, through a friction lining 30, on a torque transmission disc 29 which is attached together with a sealing membrane 14 for the chamber 7.

Fig.1



GB 2 251 284 A

Fig.1

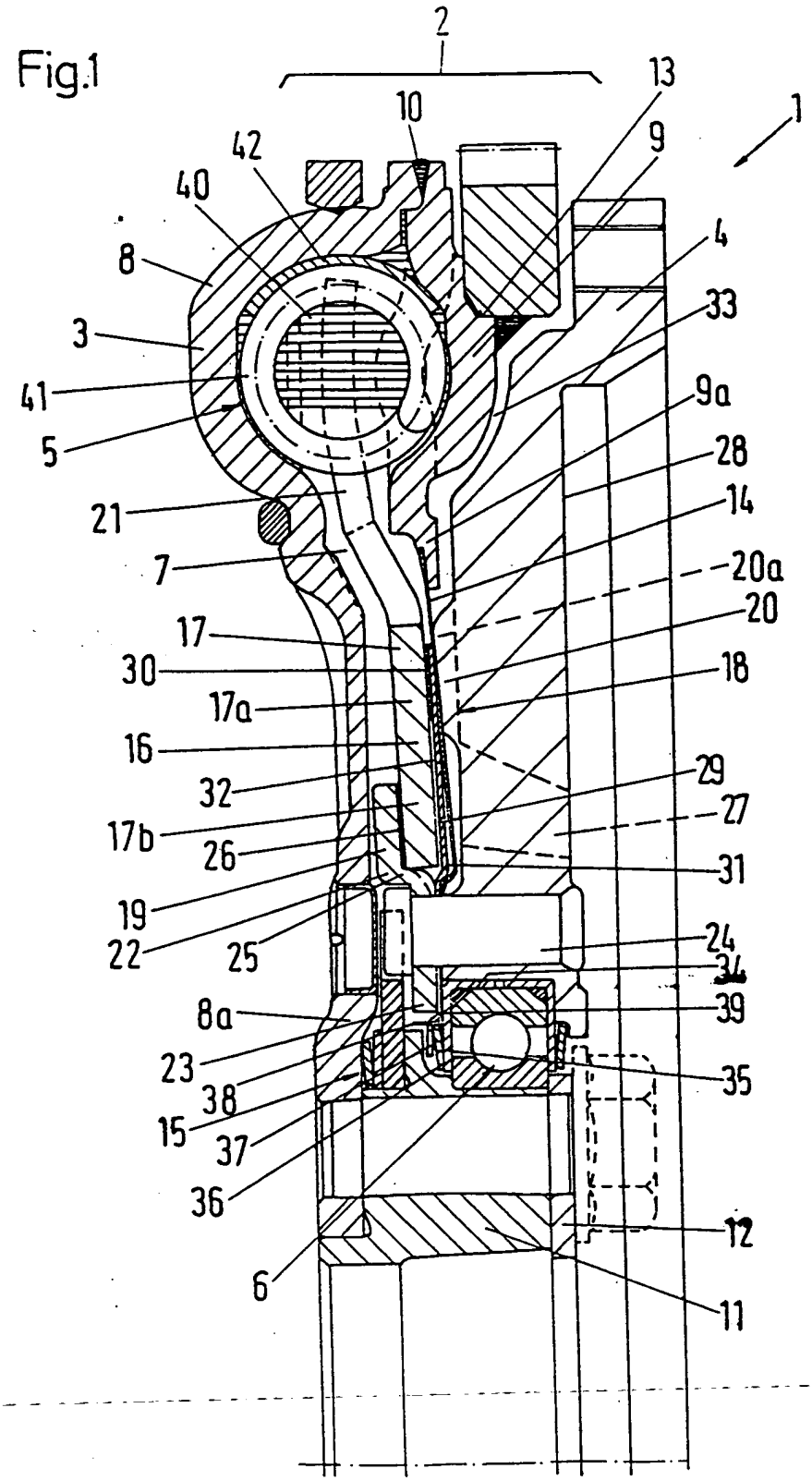
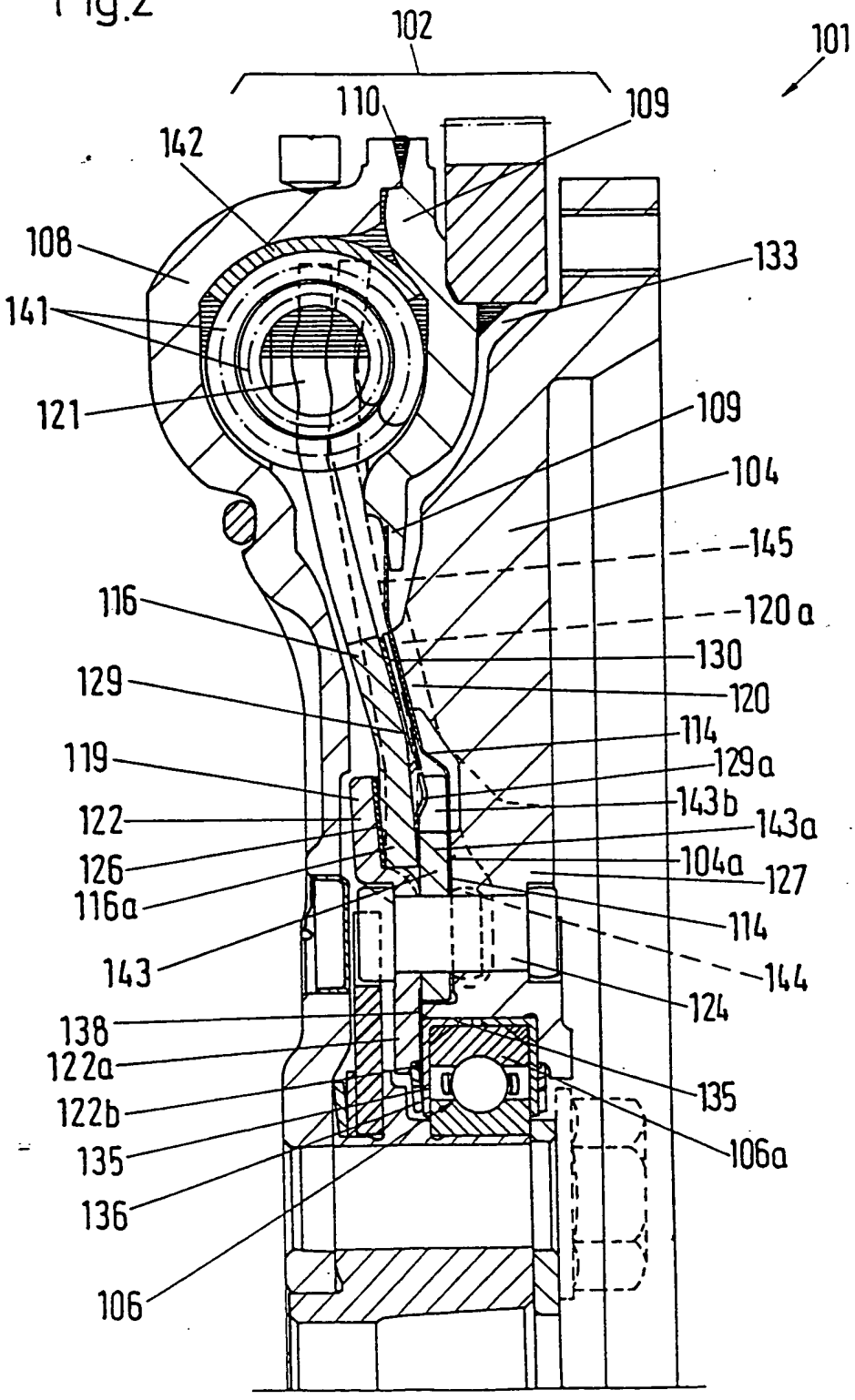

2
13
10
9
1
42
40
4
8
33
3
9a
41
28
5
14
21
20a
7
20
17
18
30
17a
16
29
32
27
17b
26
31
19
24
22
25
34
8a
39
23
35
38
15
37
36
12
6
11

Fig.2


102
101
110
109
142
108
133
141
121
109
104
145
120a
116
130
129
120
114
119
129a
143b
143a
122
126
104a
127
116a
114
144
143
124
138
122a
135
122b
135
106a
136
106

Device for damping vibrations

The invention relates to a device for damping vibrations, more particularly in the drive train of a vehicle between engine and gearbox, with at least two elements rotatable relative to each other wherein one element is connectable to the engine and the other element is connectable to the gearbox and between the elements there is at least one rotationally elastic damper and a slip clutch active therewith which has a plate-spring like component which is axially tensioned between two radially off-set annular or ring-like support areas which are coupled rotationally secured to one of the elements and which plate spring like component is mounted in the force flow between the damper and slip clutch, and wherein the other of the elements serves to form an annular space which is closed towards the outside and is filled at least partially with a viscous medium.

Devices of this kind are known from DE-OS 39 09 892.

The object of the present invention is to improve such devices, particularly with regard to their construction, ease of assembly and function. Furthermore an axially compact method of construction and economical manufacture are also to be ensured.

This is achieved according to the invention in that the radially further outer support of the plate spring like component is achieved through the interposition of a torque transfer disc and a sealing membrane for the annular space on the one element.

Through such a design it can be ensured that a very thin sealing membrane can be used which is not deformed through

the contact pressure or axial force of the plate spring like component since a satisfactory axial contact or impingement of the membrane can be ensured through the torque transfer disc. Furthermore or additionally through the use of a torque transfer disc it is ensured that the torque transferred in the radially outer support area is not introduced into the sealing membrane so that a deformation or distortion thereof can be avoided. A further advantage lies in the fact that the axial force applied by the plate spring like component is taken up by one of the relatively rotatable but axially secured elements so that the torque transfer disc need only transfer the torque part introduced in the area of the radially outer support of the plate spring like component and does not have to absorb or support the axial force of the plate spring like component. A space-saving design is thereby possible since the torque transfer disc can be made from a comparatively thin material, more particularly spring steel plate.

The design according to the invention can be used particularly advantageously in so-called divided flywheels wherein then the two elements form the two flywheel masses of the flywheel which are rotatable relative to each other. It can thereby be expedient if the element which forms substantially the annular space filled at least partially with a viscous medium is the primary flywheel mass which is connected to the output shaft of an engine and the element supporting the support areas forms the secondary mass which is connectable by a switchable clutch to the input shaft of a gear box.

The plate spring like component can advantageously be designed so that it has a circular ring shaped spring foundation body and cut-out sections to hold the energy accumulators which are provided outside of the foundation

body. The cut-out sections can thereby be formed by recesses opening radially to the outside or however also by windows closed over the circumference.

It can be particularly advantageous if one of the elements directly forms the input part of the rotationally elastic damper whose output part is formed by the plate-spring like component which is connected in force locking engagement with the other element by the slip clutch.

It can be particularly advantageous for the assembly and functioning of the device if both the torque transfer disc and also the sealing membrane are axially resilient. It is thereby possible to avoid permanent deformation on these components during assembly of the device which could impair the function of the device. It can be particularly advantageous if the sealing membrane is clamped axially between the one element and the torque transfer disc wherein it can then be particularly expedient if at least the torque transfer disc is connected rotationally secured to the one element without rotational play. It is thereby guaranteed that the very thin sealing membrane is housed axially between two components which are connected rotationally secured to each other so that no circumferential forces can act on the membrane.

In order to obtain a definite friction moment in the slip clutch or torque restriction clutch it is expedient if a friction lining such as a friction or slide ring are provided between the torque transfer disc and the plate-spring like component.

For a satisfactory sealing of the annular space it can be advantageous if the sealing membrane extends radially further outwards than the torque transfer disc. The sealing

membrane can thereby be supported on the radially inner areas of a wall forming the annular space.

The inner support for the plate-spring like component can be formed in a particularly simple way by a disc part which can serve at the same time to axially secure a rolling bearing which supports the two flywheel masses rotatable relative to each other.

A particularly advantageous construction of the device can be achieved in that the torque transfer disc and the sealing membrane are fixedly connected to the one element both axially and circumferentially. To this end an annular disc part can be used which can form at the same time the radially inner support for the plate-spring like component wherein this annular disc part is then fixedly connected on the one element with the interposition of the torque transfer disc and the sealing membrane. The connection can thereby be made by rivet connections which can be provided adjoining the outer area of a rolling bearing.

In devices whose two elements, such as flywheel masses are positioned rotatable relative to each other through a rolling bearing which is sealed by two sealing caps which each have a radial arm which radially overlaps the two bearing rings and is pressed by an energy accumulator against the inner bearing ring it can be particularly expedient if the torque transfer disc serves to axially support an energy accumulator of this kind, such as a plate spring. For this the torque transfer disc and/or the sealing membrane can extend radially further inwards than the disc part which forms the radially inner support for the plate-spring like component.

For the assembly of the device it can be advantageous if

positioning means are provided between the torque transfer disc and the sealing membrane. For this one of these parts can have axial formed areas and the other part recesses in which the formed areas engage.

For the assembly of the device it can furthermore be advantageous if a disc part forming the radially inner support for the plate spring like component is fixedly connected to a disc and radially inner areas of the plate spring like component are housed axially between the disc part and disc. The areas of the disc part and disc engaging over the inner areas of the plate spring like component are thereby expediently provided at such an axial spacing that the plate-spring-like component can be held in an axially pretensioned position during the assembly of the device. The connection between the disc part and the disc can be produced eg by rivet connections. The plate-spring like component, the disc part and the disc thereby form one sub-unit during assembly of the device. The formation of such a sub-unit is particularly advantageous when the annular space filled at least partially with a viscous medium is formed by two dish like bodies since it is then possible to avoid having to deform the plate spring like component substantially resiliently over one of these bodies during axial fitting of the two dish bodies. Furthermore such a sub-unit has the advantage that other components such as eg helical springs, dish bodies, sealing membranes etc can be better combined and positioned during assembly of the device.

It can be particularly advantageous for the assembly and functioning of the device if the torque transfer disc is coupled to the disc, which holds the plate spring like component in a pretensioned state during the assembly of the device, by means of a rotationally secured connection which

does however allow an axial displacement. This type of connection can be formed by interengaging profiled sections and counter profiled sections which are formed on the torque transfer disc and on the disc. It can furthermore be expedient if the torque transfer disc is held centred by the disc which is rotationally secured to same. It can furthermore be advantageous if the sealing membrane engages radially over the torque transfer disc and is clamped axially between this disc and the one element.

Further advantageous features and design possibilities, particularly regarding the arrangement and configuration of the or each damper and elements or flywheel masses which can be used in conjunction with the subject of the present invention, are shown and described in the DE-OS 39 09 892 already mentioned at the beginning.

The invention will now be explained in detail with reference to Figures 1 and 2 which each show a half section through a device according to the invention.

The torque transfer device 1 illustrated in Figure 1 for compensating rotary shocks has a flywheel 2 which is divided into two flywheel elements 3 and 4. The flywheel element 3 is fixable on the output shaft of an internal combustion engine (not shown in further detail) by screws. A switchable friction clutch is fixable on the flywheel element 4. By operating a friction clutch of this kind the flywheel element 4 and thus also the flywheel 2 and internal combustion engine can be coupled with and uncoupled from the input shaft of a gear box. Between the flywheel element 3 and the flywheel element 4 there is a damping device 5 which allows a relative rotation between the two flywheel elements 3 and 4. The two flywheel elements 3 and 4 are positioned rotatable relative to each other by a bearing 6.

The flywheel element 3 forms a housing which defines an annular chamber 7 in which the damping device 5 is accommodated.

The flywheel element 3 having the annular chamber 7 consists substantially of two dish like housing parts 8,9 which are connected together radially on the outside. The two housing parts 8,9 are formed by sheet metal parts which are connected on their outer circumference by welding 10. This welding 10 also seals at the same time the annular chamber 7 radially towards the outside.

The housing half 8 facing the engine supports on the inside an axial attachment 11 on which is fitted the rolling bearing 6 which supports the two flywheel elements 3 and 4 relative to each other. A disc 12 is fixed on the end side of the attachment 11 to secure the bearing 6.

The housing part 9 has a seat 13 on which a starting gear ring is set.

In order to seal the annular chamber 7 a membrane-like seal 14 is provided between the radially inner area or edge of the housing part 9 and the flywheel element 4.

Furthermore a friction device 15 which is likewise set in the annular chamber 7 acts between the flywheel elements 3 and 4. The friction device 15 is provided around the axial attachment 11 of the housing part 8 as well as axially between the rolling bearing 6 and the radial flange area 8a of the housing part 8 on the engine side.

The output part of the damper 5 is formed by a flange-like component 16 which is mounted axially between the two housing parts 8,9. The flange-like component 16 is

connected in force locking engagement by its radially further inner areas 17 with the flywheel element 4 by way of a torque restriction or slip clutch 18. The flange-like component 16 is tensioned axially between two radially off-set support areas 19,20. For this the flange-like component 16 is designed like a plate spring so that this is resilient in the axial direction. In the dismantled state the flange-like component 16 has a certain conicity - similar to a plate spring. The flange-like component 16 has a full-length circular ring-shaped foundation body 17 which has on its outer circumference radially outwardly aligned extension arms 21. When installing the flange-like component 16 between the two support areas 19,20 the circular ring shaped foundation body 17 is tensioned axially so that it is supported by radially outer areas 17a on the one support area 20 and by radially further inner areas 17b on the annular component 22.

The radially further inner support area 19 is formed by the outer ring area 19 of the ring-like component 16 which is connected by a radially further inner fastening area 23 to the flywheel element 4 on the gearbox side by rivet connections 24. The outer ring area 19 and the inner likewise ring shaped fastening area 23 are off-set axially relative to each other and are connected together by an axially aligned area or ledge 25. The resilient flange-like component 16 is centred and housed on the axially aligned area 25. A friction ring 26 is provided axially between the ring area 19 and the resilient component 16.

The radially outer support 20 for the plate-spring like component 16 is formed by an axial raised area 20 formed on the rear side of the flywheel element 4. This raised area can be formed by several axial protrusions or projections spread out over the circumference and between which are

formed radial clearances or passages 20a through which cooling air can circulate. In order to produce a cooling air circulation of this kind the flywheel element 4 has axial passages 27 which open in radially inside the friction face 28 of the flywheel element 4 and exit on the back of the flywheel element 4.

The axially pretensioned foundation body 17 of the flange-like component is supported on the support area 20 with the interposition of the membrane-like seal 14 as well as a likewise membrane-shaped disc 29. A friction lining 30 is provided between the membrane-like disc 29 and the outer friction area 17a of the flange-like component 16. The disc 29 and the sealing membrane 14 is secured against distortion relative to the flywheel element 4. To this end radially inner areas of these parts 14,29 are clamped axially between the disc 22 and a contact bearing face of the flywheel element 4 by means of rivet connections 24. The parts 14 and 29 are made from spring sheet steel so that they can yield resiliently during assembly and thus undergo no permanent deformation. The sealing membrane 14 extends radially outwards over the disc 29 and is supported resiliently on a shoulder 9a of the housing part 9. The sealing membrane 14 (thickness 0.15 to 0.25 mm) is thinner than the membrane-like disc 29 (thickness 0.4 to 0.7 mm) so that it has a very large axial elasticity and very low spring force whereby it is ensured that in the area of the support between the housing part 9 and the sealing membrane 14 only a comparatively slight friction is produced during a relative rotation between the two flywheel elements 3 and 4.

The membrane-like disc 29 serves to transfer the torque part which is transferred via the radially outer friction-connection between the friction ring 30 and the outer

friction area 17a of the flange-like component 16. Through the torque transfer disc 29 it is ensured that the sealing membrane 14 clamped between this disc 29 and the support area 20 is not deformed by the contact pressure force or through the axial force of the plate-spring like component 16. Furthermore through the rotationally secured coupling of the torque transfer disc 29 with the secondary flywheel element 4 it is ensured that no torque is introduced into the sealing member 14 so that a deformation or distortion thereof can be avoided whereby a satisfactory seal through the membrane in the area of the support on the shoulder 9a is also ensured.

The areas of the sealing membrane 14 and torque transfer disc 29 extending radially axially between the second flywheel mass element 4 and the flange-like component 16 have a different assembly angle so that an air gap 31 of wedged cross-section is formed between these two components 14,29. A further air gap 32 is provided between the flange-like component 16 and the torque transfer disc 29. Furthermore a gap 33 opening radially to the outside is provided between the second flywheel mass element 4 on one side and the sealing membrane 14 and housing part 9 on the other side so that the cooling air which is drawn in radially through the axial passages 27 can circulate through said gap. Through the axial passages 27, the radial passages 20a and the air gaps 33,31 and 32 it is possible to insulate the space 7 filled at least partially with viscous medium from the thermal effects which arise as a result of the friction heat during engagement of the friction clutch which is fixed on the second flywheel element 4. The friction ring 30 which consists of a material having only a slight heat conductivity likewise helps in the thermal insulation of the primary flywheel mass 3.

The sealing membrane 14 and the torque transfer disc 29 have in the untensioned state a frustoconical shape, namely the radially outer areas of these components 14,29 are off-set right in the relaxed state relative to the illustrated radially inner ares of these components. When forming the rivet connections 24 the plate spring like component 16, the torque transfer disc 29 and the sealing membrane 14 are brought into the position illustrated in Figure 1.

The rolling bearing 6 is sealed by means of two sealing caps 34 which serve at the same time as thermal insulation and have a radial arm 35 which overlaps both the radially outer and radially inner bearing ring and which is pressed by a plate spring 36 against the inner bearing ring. The torque transfer disc 29 extends radially further inwards than the annular component 22 wherein the overlapping ares 37 of the torque transfer disc 29 serve to support axially the outer areas of a plate spring 36. The sealing membrane 14 extends likewise radially further in than the annular component 22 and has on its radially inner ares or contours axial formed areas in the form of flaps 38 which are bent down axially in the direction of the housing part 8 and engage in recesses 39 of the areas 37 of the torque transfer disc 29. The keyed engagement thus formed between the sealing membrane 14 and the torque transfer disc 29 guarantees a satisfactory positioning of the parts 14,19 during assembly of the torque transfer device 1.

The two housing parts 8,9 form radially on the outside an annular channel like or toroidal socket 40 which is divided into individual annular arc-shaped or sector-shaped sockets in which the springs 41 are housed. The radial extension arms 21 of the flange-like component 16 extend - viewed circumferentially - between adjoining springs 41 radially into the annular channel like socket 40 and form impingement

areas for these springs 41.

In order to reduce the wear on the radial support areas of the annular channel like socket 40 for the springs 41, protection means 42 are provided having an increased hardness and extending at least in the areas of the springs 41 over the circumference of the annular channel like socket 40 to enclose in part the springs 41.

A viscous medium, such as a lubricant in the form of a paste-like medium such as grease is provided in the annular channel-like socket 40 which forms the outer areas of the annular chamber 7.

Reference is made to the DE-OS 39 09 892 regarding the possible design of the housing parts 8,9 and the arrangement of the springs 41 as well as the method of operation of the torque transfer device.

With the torque transfer device 101 illustrated in Figure 2 the radially inner areas 116a of the flange-like component 116 which is axially resilient in the manner of a plate spring are accommodated axially between a ring-like component 122 and a ring disc 143. The ring-like component 122 and the ring disc 143 are fixedly connected together axially by rivet connections 144 and together form with the flange-like component 116 a pre-assembled sub-unit. The ring-like component 122 is designed the same as described in connection with Figure 1. During the assembly of the torque transfer device 101 the components 122,143 which are already fixedly connected by the rivets 144 are connected to the flywheel element 104 on the gearbox side by means of rivet connections 124 which are circumferentially off-set relative to the rivets 144. The radial areas 119 and 143a of the components 122,143 engaging round the radially inner area

116a of the flange-like component 116 are spaced out so that the plate-spring like component 116 is held in the pretensioned position shown in chain-dotted lines and marked by 145. This position 145 of the flange-like component 116 ensures that during assembly of the two housing parts 108,109 which are connected together eg by means of welding 110 the flange-like component 116 need not or only slightly be elastically deformed over the housing part 109. Furthermore through the pretensioned position 145 of the flange-like component 116 it is ensured that during assembly of the torque transfer device 101 the radially outer arms 121 which serve to impinge on the energy accumulators 141 can be inserted axially between the end areas of adjoining energy accumulators 141 and segment-shaped anti-wear dishes 142. Assembly is thereby substantially easier since at least the energy accumulators 141 and if required the anti-wear dishes 142 can already be positioned in the circumferential direction through the extension arms 121.

As with Figure 1, in Figure 2 the ring-like component 122 forming the radially inner support areas 119 serves for the axial securement of the rolling bearing 106 on the flywheel element 104 on the gearbox side. To this end the disc 122 engages with its radially inner areas 122a over the outer bearing ring 106a of the rolling bearing 106. The rolling bearing 106 is in a similar way to that described in conjunction with Figure 1 sealed by means of sealing caps wherein however the plate spring 136 facing the housing part 108 for pressing the radially inner areas of the radially aligned sealing arm 135 of the sealing cap 134 is supported directly on the radially aligned areas of a step 122b imprinted as a recess on the inner edge of the disc 122. In order to facilitate the assembly of the torque transfer device 1 the plate spring 136 is held both secured in the axial direction and also centred relative to the disc 122.

For this a disc 138 is provided which is made from the inner punched out waste of the sealing membrane 144 and which is held axially between the two discs 122,143. The radially inner areas of the disc 138 overlap the radially outer areas of the plate spring 136.

The sealing membrane 114 is supported radially outwards on the inner areas 109a of the housing part 109 forming a radial wall. The radially inner areas 114a of the sealing membrane 114 are clamped axially between an end face 104a of the flywheel element 104 and the disc 143.

The torque transfer disc 129 provided axially between the sealing membrane 114 and the flange-like component 116 has on the inner edge profiled sections in the form of radially directed extensions or arms 129a which engage in counter profiled sections provided on the outer circumference of the disc 143 in the form of radial incisions 143b. The profiled sections 129a and counter profiled sections 143b conform with each other so that a centring of the torque transfer disc 129 relative to the disc 143 is ensured through this keyed connection. The torque part which must be transferred by the disc 129 is introduced into the disc 143 through the arms 129a.

As described in connection with Figure 1, also in the embodiment according to Figure 2 friction linings 126, 130 are provided between the discs 122,129 and the flange-like component 116.

The torque transfer disc 129 and the sealing membrane 114 have, as already described in connection with Figure 1, in the relaxed state a shape which is different from that shown in Figure 2, namely the two components 129,114 are set up in the relaxed state at least so that the sections clamped

between the support area 120 of the flywheel element 104 and the flange-like component 116 run at least approximately parallel to the adjoining sections of the flange like component 116 located in the partially relaxed position 145.

As already described in connection with Figure 1 axial passages 127, radial channels 120a and an air gap 133 are provided for improved cooling of the torque transfer unit 101.

The invention is not restricted to the embodiments described and illustrated but more particularly embraces variations which can be formed by combination of individual features or elements described in connection with the different embodiments.

Patent Claims

1. Device for damping vibrations, more particularly in the drive train of a vehicle between engine and gearbox with at least two elements rotatable relative to each other wherein one element is connectable with the engine and the other element is connectable with the gearbox and between the elements there is provided at least one rotationally elastic damper and a slip clutch which acts in series therewith and which has a plate-spring like component which is tensioned axially between two radially off-set support areas which are coupled secured against rotation to one of the elements, and which is mounted in the force flow between the damper and slip clutch, and wherein the other of the elements serves to form an annular space closed towards the outside and filled at least partially with a viscous medium, characterised in that the radially outer support of the plate spring like component is carried out with the interposition of a torque transmission disc and a sealing membrane for the annular space on the one element.

2. Device according to claim 1 characterised in that the two elements form the two flywheel masses of a divided flywheel.

3. Device according to claim 1 or 2 characterised in that the torque transfer disc and the sealing membrane are axially resilient.

4. Device according to one of claims 1 to 3 characterised in that the sealing membrane is clamped axially between the one element and the torque transfer disc.

5. Device according to one of claims 1 to 4 characterised in that a friction lining such as a friction ring is

provided axially between the outer area of the torque transfer disc and the plate spring like component.

6. Device according to one of claims 1 to 5 characterised in that the radial extension of the sealing membrane is larger radially towards the outside than that of the torque transfer disc.

7. Device according to one of claims 1 to 6 characterised in that a disc part forming the inner support for the plate spring like component serves at the same time for axially securing a rolling bearing which supports the two flywheel masses rotatable relative to each other.

8. Device according to one of claims 1 to 7 characterised in that the torque transfer disc and the sealing membrane are fixed on one element.

9. Device according to one of claims 1 to 8 characterised in that the radially inner support of the plate spring like component is formed by a annular disc part which is fixedly connected (rivetted) to the one element through the interposition of the torque transfer disc and the sealing membrane.

10. Device according to one of claims 1 to 9 wherein the two elements are rotatable relative to each other through a rolling bearing and the rolling bearing is sealed by sealing caps which have a radial arm which overlaps both bearing rings radially and is pressed by an energy accumulator against the inner bearing ring, characterised in that the torque transfer disc serves for axially supporting one such energy accumulator.

11. Device according to one of claims 1 to 10 characterised

in that the torque transfer disc and/or the sealing membrane extend radially further inwards than the disc part which forms the radially inner support for the plate spring like component.

12. Device according to one of claims 1 to 11 characterised in that one of the two parts torque transfer disc and sealing membrane has axial formed areas and the other of these parts has recesses into which the axial formed areas engage in order to position the two parts relative to each other.

13. Device according to one of claims 1 to 12 characterised in that a disc part forming the radially inner support for the plate spring like component is fixedly connected to a disc and radially inner areas of the plate spring like component are set axially between the disc part and the disc.

14. Device according to claim 13 characterised in that the areas of the disc part and disc engaging over the inner areas of the plate spring like component are provided at such axial spacing that the plate spring like component can be held in an axially pretensioned position.

15. Device according to one of claims 13 or 14 characterised in that the torque transfer disc is coupled to the disc which is connected axially secured to the disc part by a connection which is rotationally secured but allows an axial displacement.

16. Device according to claim 15 characterised in that the connection is formed by interengaging profiled areas and counter profiled areas which are formed on the torque transfer disc and on the disc.

17. Device according to one of claims 13 to 16 characterised in that the torque transfer disc is held centred by the disc which is rotationally secured to same.

18. Device according to one of claims 13 to 17 characterised in that the sealing membrane engages radially over the disc and is clamped axially between this disc and the one element.

19. Device for damping vibrations, substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
9126678.3

Relevant Technical fields

(i) UK Cl (Edition K) F2U

(ii) Int Cl (Edition 5) F16F15/12; F16D

Search Examiner
T S SUTHERLAND

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
29 JANUARY 1992

Documents considered relevant following a search in respect of claims **ALL**

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2217429 A (LUK LAMELLEN) see Figure 3, annular disc 145, seal 134. This is the GB equivalent of the acknowledged prior art	1

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

Published 1992 at The Patent Office, Concept House, Cardiff Road, Newport, Gwent NP9 1RH. Further copies may be obtained from Sales Branch, Unit 6, Nine Mile Point, Cwmfelinfach, Cross Keys, Newport, NP1 7HZ. Printed by Multiplex techniques ltd, St Mary Cray, Kent.